



**UNITED STATES AIR FORCE
INSTALLATION RESTORATION PROGRAM
KELLY AIR FORCE BASE
SAN ANTONIO, TEXAS**

Final Site S-1 Soil Focused Feasibility Study

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Kelly Air Force Base, Texas
Contract No. F4 1650-92-D-3004-5008

EXECUTIVE SUMMARY

Introduction

This Focused Feasibility Study (FFS) addresses soil contamination at a specific Kelly Air Force Base (AFB) Installation Restoration Program (IRP) site known as Site S-1, which is located in Zone 5. Zone 5 is one of five investigation zones (Zones 1 through 5) that make up Kelly AFB.

Site S-1, a former intermediate waste storage area, is located within a few hundred feet of the northern Kelly AFB property boundary where soil contamination has been detected. Wastes were stored here from the 1960s until 1973. Wastes stored in the area included solvents, carbon cleaning compounds, and petroleum, oil, and lubricants. Site contamination was likely caused by spills and overfills during loading and unloading and spillage while in storage in the sump area. Land use in the area is mixed and includes residential, commercial, and light industrial uses. Various industrial sites and the North Kelly Gardens residential area are located immediately north of the base near Site S-1.

This FFS, which presents measures to address Zone 5 Site S-1 soil contamination, is being prepared as part of a phased approach to the entire Zone 5 remediation. The approach includes remedial investigation (RI) activities for Site S-1, RI activities for the entire Zone 5, FFS activities for interim measures to restrict contaminated shallow groundwater migration off base, subsequent FFS activities addressing shallow groundwater migration from Zone 5, a Zone 5 corrective measures study (CMS), basewide chlorobenzene (CB) natural attenuation study activities, and Site S-1 soil FFS activities.

Summary of Investigations

The Site S-1 investigation began with Phase I and Phase II IRP investigations in 1983 and 1986; these investigations are included as part of the Site S-1 RI report prepared in 1994.

Based on the Site S-1 soil sampling results, the greatest concentration of organic soil

contaminants at Site S-1 is present within the former sump area at depths near and below the water table. The primary contaminant of concern found at Site S-1 is CB because of its prevalence in soil samples and because it is the most widespread and is at the highest concentrations in the groundwater. The greatest concentrations of CB were found at depths below 14 feet. This is believed to correspond to the original depth of the sump where disposal would have occurred.

An oily layer or oil sheen was found at depths ranging from 18 to 24 feet below ground surface (bgs) within the former sump. CB concentrations sometimes were elevated in samples where the oil was present although some samples from oily layers had little CB. Elevated CB also was found in samples with no reported oil or oil sheen.

The CB is more widespread at the greater depths as a result of contaminant transport in the groundwater or dissolved in light nonaqueous phase liquid (LNAPL) oil. The oil is lighter than water and spread outward from the former sump on the surface of the water table. As the water table fluctuated over several feet, the LNAPL was smeared across this zone of water table fluctuation, herein referred as the smear zone. Much of this more widespread CB contamination is present above the current water table.

Several other organic contaminants are present in site soils and were most often detected in soils that also had elevated CB. These are 1,2-dichlorobenzene (1,2-DCB), 1,4 dichlorobenzene (1,4-DCB), 2-methylnaphthalene, naphthalene and, to a lesser extent, benzene, toluene, ethylbenzene, and xylene (BTEX). Total petroleum hydrocarbons (TPHs) were analyzed in recent borings, and polychlorinated biphenyls (PCBs) and inorganics also exist within the soil at Site S-1.

Inorganics including barium, lead, zinc, cadmium, silver, antimony, chromium, copper, selenium, manganese, and arsenic were detected above background levels in surface, mid-zone, and deep-zone sample locations.

Groundwater contamination is also present at Site S-1. The most widespread and greatest concentration contaminant is CB. The existing groundwater collection and treatment system is collecting the groundwater near the base boundary.

Summary of Risk Assessment

The Site S-1 risk assessment found that the site did not pose a human health or ecological risk as a result of exposure to the contaminated soil. No unacceptable risks were found for ingestion or dermal contact with soil or inhalation of particulates and volatile organic chemicals (VOCs) under industrial maintenance or construction-worker exposure scenarios. Potential cancer risks incurred by on-site receptors (base personnel) are within the current EPA guidance ranges of 10^{-6} and 10^{-4} .

However, unacceptable risks do exist if the groundwater below and downgradient of the site is used as a drinking water supply. Based on the most recent site sampling results, it appears that soil contaminants are leaching to groundwater, causing the groundwater to continue to exceed federal drinking water maximum contaminant levels (MCLs) and Texas media specific concentrations (MSCs). As a result, an objective of interim remedial actions for the soil media at Site S-1 is to minimize the leaching of contaminants at concentrations sufficient to cause exceedance of drinking water MCLs or Texas groundwater MSCs in the groundwater.

The results from the worst-case groundwater risk assessment indicates that the aquifer at Site S-1 is not suitable for developing as a drinking-water source and could adversely affect downgradient

drinking-water wells. Risks from residential use of groundwater are above the levels considered acceptable. The chemicals contributing to the majority of the noncarcinogenic risk under the worst-case scenario are CB and arsenic.

Summary of Remedial Objectives

Based on the most recent site sampling results, it appears that soil contaminants are leaching to groundwater causing the groundwater to continue to exceed federal drinking water maximum contaminant levels (MCLs) and Texas media-specific concentrations (MSCs). As a result, an objective of interim remedial actions for the soil media at Site S-1 is to minimize the leaching of contaminants at concentrations sufficient to cause exceedance of drinking water MCLs or Texas groundwater MSCs in the groundwater.

Preliminary remediation goals (PRGs) were developed for all contaminants detected at the site. The three primary contaminants exceeding PRGs for protection of groundwater are CB, 1,2-DCB, and 1,4DCB. The areas exceeding PRGs are from 14 feet bgs to the top of the Navarro for the sump area and two areas downgradient of the sump within the smear zone.

Remedial Alternatives

Sump Area

The following are six alternatives for the sump area soils:

- No further action. Under this alternative, the contaminants would continue to migrate to the groundwater and may result in groundwater concentrations exceeding PRGs for decades.
- Natural attenuation. The main components of this alternative include institutional controls, natural attenuation, and environmental monitoring.
- Capping. The main components of this alternative include institutional controls, site capping, and environmental monitoring.
- Soil vapor extraction (SVE). The main remedial components of the SVE alternative are institutional controls, SVE construction and operation, and environmental monitoring.
- Excavation and disposal. The major remedial components of this alternative include excavation, off-site disposal, and confirmatory sampling. This alternative physically removes the contaminants exceeding PRGs.
- Ex-situ biological treatment. This alternative involves excavating and stockpiling relatively uncontaminated soil (less than 14 feet bgs), excavating and treating the contaminated soil exceeding PRGs via ex situ biological treatment, replacing the stockpiled soil, backfilling the remainder of the excavated hole with clean soil, and disposing of the treated soil in a Texas Class I landfill.

Smear Zone

The following are four alternatives for the smear zone soils:

- No further action. Under this alternative, the soil in the smear zone may act as a continuous source to the dissolved phase groundwater contamination for decades.

- Natural attenuation. The natural attenuation alternative for the smear zone is similar to the sump area natural attenuation alternative in terms of remedial objectives and effectiveness.
- SVE. The remedial components of this alternative include SVE construction and operation and environmental monitoring.
- Dual-phase groundwater recovery and SVE. The remedial components of this alternative include SVE construction and operation, groundwater recovery and treatment, and environmental monitoring.

Recommended Alternatives

Sump Area

The excavation and off-site disposal alternative is the recommended alternative for the sump area soils. The alternative will effectively reduce the overall risk to human health and the environment by physically removing the CB, 1,2-DCB, and 1,4-DCB contamination that exceeds preliminary remediation goals (PRGs) from the affected sump area. The cost for this alternative is \$601,000.

Smear Zone

The dual-phase groundwater recovery and SVE is the recommended alternative for the smear zone. Recent water level measurements show the water table has increased in response to higher infiltration. Because it is important to maintain the water table below the smear zone, the dual-phase extraction system is considered to be an important component of the alternative. The recommended alternative will effectively reduce the overall risk to human health and the environment by physically removing and enhancing aerobic degradation of the CB, 1,2-DCB, and 1,4-DCB contamination that exceeds PRGs. The cost for this alternative is \$756,000.